Supplementing the diets of elderly dogs

Practitioners should not assume that a balanced, commercial dog food will fulfill the nutrient requirements of each animal, especially geriatric patients.

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THE DECISION of whether to supplement the diet of elderly dogs confronts practitioners daily. Some of the factors affecting this decision include assessment of past and present nutritional status, presence of chronic disease, biochemical and physiologic individuality, economics, and the attending veterinarian's attitude toward the concept of specific nutrient needs for dogs of varying ages.[1]

Unfortunately, there have been few studies of specific nutritional deficiencies in the aged dog. Most studies on aging have used human beings and rats as subjects. However, generalizations from these studies may be applied to dogs more readily than most interspecies generalizations because degeneration of the kidneys is a major feature of senility in all three species.[2] Aging might increase dietary requirements for arginine as the kidneys deteriorate; tryptophan, tyrosine, and choline might be needed as the brain atrophies.[3] Further, elderly animals may have increased destruction of vitamins B_1, B_2, and B_6.[3] Studies of the effect of aging on an animal's copper and zinc values show that serum zinc concentrations decrease after dogs reach the age of 7.5 years, whereas serum copper values begin to decrease in dogs at the age of 5.5 years.[4]

Normal morphology and function of cells and associated organs and tissues depend on adequate nutrition. A 12-year-old dog may undergo many cellular, organic, and systemic alterations that affect its nutritional needs for maintenance of reasonable health. Absorption, storage, and use of nutrients may be altered in elderly dogs as it is in human beings.[3] The ability to respond to dietary changes decreases with age. Further, generalizations of dietary needs are less applicable in aged dogs than in younger animals.

Serum vitamin levels have not been documented in the aged dog. However, studies in elderly human be-

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TABLE 1
Subjective Assessment of the Skin/Coat, Muscle Tone, and Attitude

	Group 1 Supplemented* (n = 10)	Group 2 Not Supplemented (n = 10)
Skin/coat improved	7	1
Skin/coat unchanged	3	9
Muscle tone improved	2	0
Muscle tone unchanged	8	10
Attitude improved	6	0
Attitude unchanged	4	10

*Z-Bec® Veterinary Tablets (A. H. Robins) given at manufacturer's recommended dosage.

TABLE 2
Percent Positive Change Between Pretreatment and End-of-Trial Mean Values

	Group 1 Supplemented** (n = 10) (%)	Group 2 Not Supplemented (n = 10) (%)
RBC	13	NC
WBC	9.4	2.2
Lymphocyte	14.2	8.8
Eosinophil	39	7.9
Hb	3	0.4
PCV	4	0.7
ALAT (SGPT)	42.40	8.9
Albumin	11.6	2.2

*All values remained within normal limits. Trends not significant at 5% level.
**Z-Bec® Veterinary Tablets (A. H. Robins) given at manufacturer's recommended dosage.
NC = No change.

VITAMIN/ZINC SUPPLEMENTATION

Meeting the Needs of Canine Geriatric Patients

A CLINICAL TRIAL was conducted to determine the effects of supplementing the diet of elderly dogs with a vitamin/zinc combination (Z-BEC® Vetednary Tablets—A. H. Robins). Assessment of the supplement was based on measurements of physical parameters and changes in serum values of zinc and selected hormones.

During a period of eight months, 20 dogs, each at least 11 years old, were randomly selected from the animals presented at the Kansas State University Veterinary Hospital. The dogs were assigned to one of two equal groups. All the subjects were evaluated and sampled; the owners of each dog were advised to continue feeding their pet its established commercial dog food diet throughout a 30-day study period. Group 1 dogs were given the vitamin/zinc supplement containing zinc; vitamins B_1, B_2, B_6, B_{12}, C, E; niacin; and pantothenic acid at the manufacturer's recommended dose. Group 2 dogs served as controls. Each animal was re-evaluated and sampled between Day 32 and Day 35 following initiation of the trial.

Evaluation and sampling were based on medical and nutritional history, physical examination, thoracic radiographs, electrocardiography, and serum chemistry analysis (SMA-12). Measurements were made of serum values for thyroxine, triiodothyronine, estrogen, testosterone, and zinc. Hormone concentrations were determined by radioimmunoassay.* Zinc concentrations were determined by emission spectroscopy.** A two-sample *t* test was done on the differences between Day 1 and Day 30 for both control and treatment groups. A paired-sample *t* test was done on the treatment group.***

*Neuro-endocrinology Laboratory, Department of Anatomy and Physiology, Kansas State University, Manhattan.
**Emission Spectroscopy Laboratory, Chemistry Department, KSU.
***Dr. Raja Nassar, Department of Statistics, KSU. Results of the two tests were essentially the same. Only the paired-sample *t* test is reported because it was more powerful than the two-sample *t* tests.

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How effective was dietary supplementation?

Results of subjective assessment of skin and coat condition, muscle tone, and attitude of the dogs are shown in Table 1. The hair of seven dogs from Group 1 and of one dog from Group 2 improved in glossiness, growth, and/or resiliency. Two of the seven dogs in Group 1 that were judged to have improved coats also had decreased scale formation and/or less severe hyperkeratosis.

Improved muscle tone, reflected by stance and movement, was noted in two dogs in Group 1, whereas none of the dogs in Group 2 showed improvement.

Improvement in attitude, based on increased activity, interest in surroundings, and general demeanor, was noted in six dogs in Group 1. None of the dogs in Group 2 showed improvement.

The percent changes of mean values for blood profiles from pretreatment to the end of the trial are given in Table 2. Only those values showing trends are recorded. Values for total protein, alkaline phosphatase, blood urea nitrogen, mature neutrophils, LDH, ASAT (SGOT), creatinine, calcium, phosphorus, sodium, chloride, CO_2, glucose, and potassium remained within normal limits and essentially unchanged in both groups. Radiographs and electrocardiograms were normal.

The pretreatment to end-of-trial changes in T_3, T_4, and cholesterol values are presented in Table 3. Dogs receiving the vitamin/zinc supplement had a marked increase in T_4 and T_3 values. Cholestrol values were not appreciably affected.

The effects of supplementation on zinc and vitamin-E serum values are shown in Table 4. Values of both were markedly elevated by dietary supplementation.

Estrogen and testosterone concentrations were also measured. However, because the study involved a mix of male, female, and neutered dogs, it was not possible to provide meaningful comparisons of equivalent subgroups by sex. Estrogen values were similar in males, castrated males, and spayed females. Testosterone values were lowest in intact females and highest in intact males. In this study, castrated male dogs had higher testosterone values than spayed female dogs.

The trends suggested by the change in mean values of selected blood parameters are consistent with improved health. However, along with changes in vitamin E, cholesterol, and triiodothyronine, they were not statistically significant. Results of the paired-sample *t* tests for the treated group indicated that only the change in zinc and thyroxine levels were significant between the test periods. Additional studies using larger numbers of animals would be necessary before drawing definitive conclusions.

TABLE 3
Percent Positive Change Between Pretreatment and End-of-Trial Mean Values* in Selected Hormones

	Group 1 Supplemented** (n = 10) (%)	Group 2 Not Supplemented (n = 10) (%)
Thyroxine (T_4)	56.0***	0.03
Triiodothyronine (T_3)	29.3†	0.1
Cholesterol	0.06†	0.01

*All values remained within normal limits.
**Z-Bec®, Veterinary Tablets (A. H. Robins) given at manufacturer's recommended dosage.
***Significant at the 5% level.
†Trends not significant at the 5% level.

TABLE 4
Percent Change Between Pretreatment and End-of-Trial Mean Values* of Serum Zinc and Vitamin E

	Group 1 Supplemented** (%)	Group 2 Not Supplemented (%)
Zinc (mcg/ml)	+ 72.8*** (n = 10)	+ 7.0 (n = 10)
Vitamin E (mcg/ml)	+ 75.9*** (n = 9)†	− 8.7 (n = 7)†

*Z-Bec® Veterinary Tablets (A. H. Robins) given at manufacturer's recommended dosage.
**Significant at the 1% level.
***Trend not significant at the 5% level.
†Data lost to interference in three samples and leakage in one sample.

ings revealed deficiencies of thiamine folate, nicotinate, pyridoxine, and vitamin B_{12} occurring either alone or in combination.[24] Elderly human beings given supplements containing vitamin-B complex and ascorbic acid showed increased vitality and vigor, and improvement of symptoms attributed to nonspecific senility and cerebral atherosclerosis.[5] Elderly persons also required increased levels of ascorbic acid and thiamine when fed diets known to be qualitatively adequate for young adults.[5]

The metabolism of thiamine is altered in aging physiologic systems. Thus, elderly animals demonstrating anorexia, weight loss, rough coats, ataxia, paralyses, and convulsions become likely candidates for thiamine supplementation.[25]

Chronic deficiency of riboflavin produces a dry, flaky dermatitis; marked erythema; muscular weakness of the hind quarters; conjunctivitis; vascularization of the cornea; corneal opacities; anemia; and tachycardia in the aging dog.[5] Muscle weakness, fatty liver, cheilosis, corneal opacities, and anorexia are common signs of experimentally induced riboflavin deficiencies in the dog.[26]

Signs of niacin deficiency in the aging pet include: poor appetite; reddening of the oral mucosa with ulceration; foul-smelling saliva; apathy; sluggishness; rough, scaly coat; and degenerative changes in the epithelium of the testes.[27]

Although documentation of clinical vitamin-B_6 deficiencies in elderly dogs is not available, several signs may be noted that are considered characteristic of such a deficiency. Persistent vitamin-B_6 deficiency results in a decline of the immune response in aged people.[28] Vitamin-B_6 deficiency in dogs may result in nerve degeneration, loss of conditioned reflexes, abnormal cardiac function, convulsions, anemia, atrophy of the epidermal hair follicles and sebaceous glands, hyperkeratoses of the skin, loss of appetite, and weight loss.[29] Dogs fed diets deficient in vitamin B_6 develop hypochromic anemia, high serum iron concentrations, and atherosclerosis.[30]

Vitamin E has been reported to benefit dogs with endocarditis and myocarditis. The vitamin acts both as an anti-inflammatory agent[31] and the first line of defense against peroxidation of vital membrane phospholipids. Vitamin E and selenium help prevent peroxidative damage to cells and subcellular elements.[32] Elderly dogs given vitamin E appear to regain a sense of well-being, have increased exercise tolerance, and show improved hair and skin condition.[29] Vitamin-E deficiencies result in reduced visual acuity due to degeneration of the retina, dystrophic axons, testes degeneration, ceroid pigmentation, muscle dystrophy, and vascular deficits.[28,33]

Effects of nutritional deficiencies

Several authors consider the condition of the hair and skin a mirror of the animal's state of nutrition.[6-10] Other authors associate changes in attitude and muscle tone with poor nutrition.[11,12] Nutritional deficiencies can cause mental confusion,[13] a common condition in old dogs. Deficiencies may result from decreased intake and absorption of nutrients or increased use, demand, and excretion.[14]

Researchers found that zinc values are decreased in elderly human beings and other animals.[15,16] This deficiency may be promoted by the administration of calcium, copper, excess phosphorous, and diets low in protein and high in phytate.[16] Zinc deficiency is also seen in people with chronic renal failure. Significant decreases in serum zinc values have been reported in Beagles with hypothyroidism.[16] A 40% decrease in zinc uptake was demonstrated in cells from aged rats.[20]

The benefits of zinc supplementation

Administration of zinc is thought to enhance protein anabolism, aid in DNA synthesis, contribute to normal chemotactic and phagocytic activity of leukocytes, and stabilize cell membranes.[21] Supplemental zinc has been used to treat for alopecia, keratosis, scaly skin, coarseness and brittleness of hair, seborrhea, skin infection, fading hair color, chronic inflammatory disease, testicular atrophy, lymphopenia, and lack of sphincter control.[9,22]

My experience has indicated that zinc should be considered whenever dietary supplementation of aging dogs is contemplated. (See *Vitamin/Zinc Supplementation: Meeting the Needs of Canine Geriatric Patients*, p 52.)

The improvement in condition of the coat and attitude of dogs receiving the vitamin/zinc supplement (Z-BEC® Veterinary Tablets—A.H. Robins) in this study was associated with increased serum zinc and

thyroxine values. In another study, Sprague-Dawley rats fed a zinc-deficient diet had decreased concentrations of thyrotropin-releasing hormone, triiodothyronine, and thyroxine.[23]

C nsider nutritional supplements for aged patients

Because the supplement used in this study contained zinc in combination with eight vitamins, it is impossible to identify all the elements that caused improvements noted in the supplemented group. However, preliminary evidence points to the value of the zinc fraction of the supplement; its effect on anabolic and thyroid activity; and, subsequently, its effect on rough, dry coats. Further work may define the benefits of the vitamin components.

There is no conclusive experimental evidence to indicate that excessive protein or supplements of vitamin, trace minerals, etc., increase the life span of people or animals.[24] However, the aged may need greater quantities of certain nutrients to compensate for inefficient absorption and enzymatic performance.[15] Nutritional concerns also arise from the studies on chronic disease.[16]

The improvement noted in 70% of the elderly dogs receiving the vitamin/zinc supplement in this study reinforces the potential benefit of dietary supplementation. This is especially true when an aged dog exhibits signs suggesting a nutrient deficiency.

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